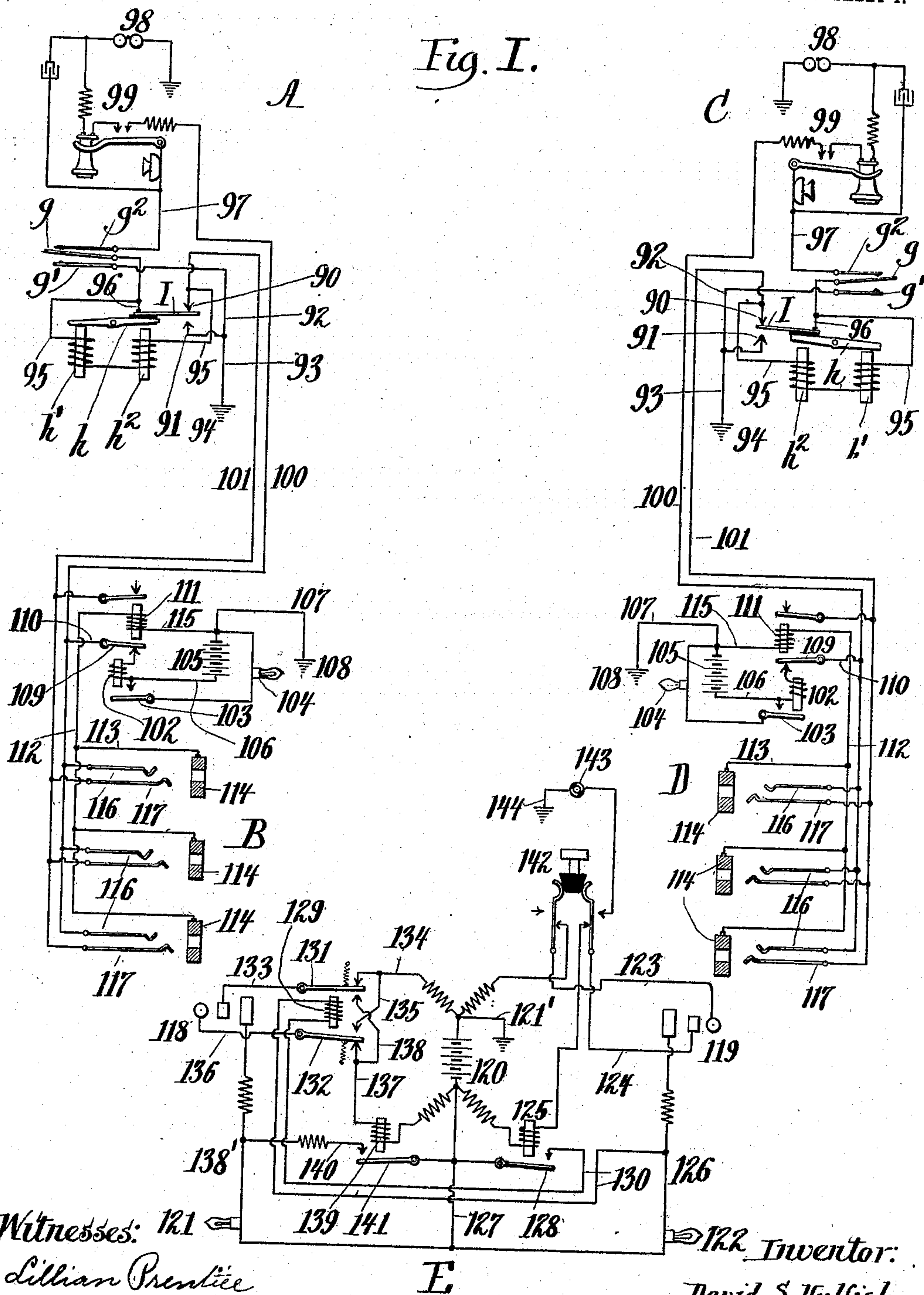


907,804.

D. S. HULFISH.
TOLL TELEPHONE SYSTEM.
APPLICATION FILED MAR. 28, 1903.

Patented Dec. 29, 1908.
4 SHEETS—SHEET 1.

Fig. I.



Witnesses: 121
Lillian Prentice
James H. Peirce

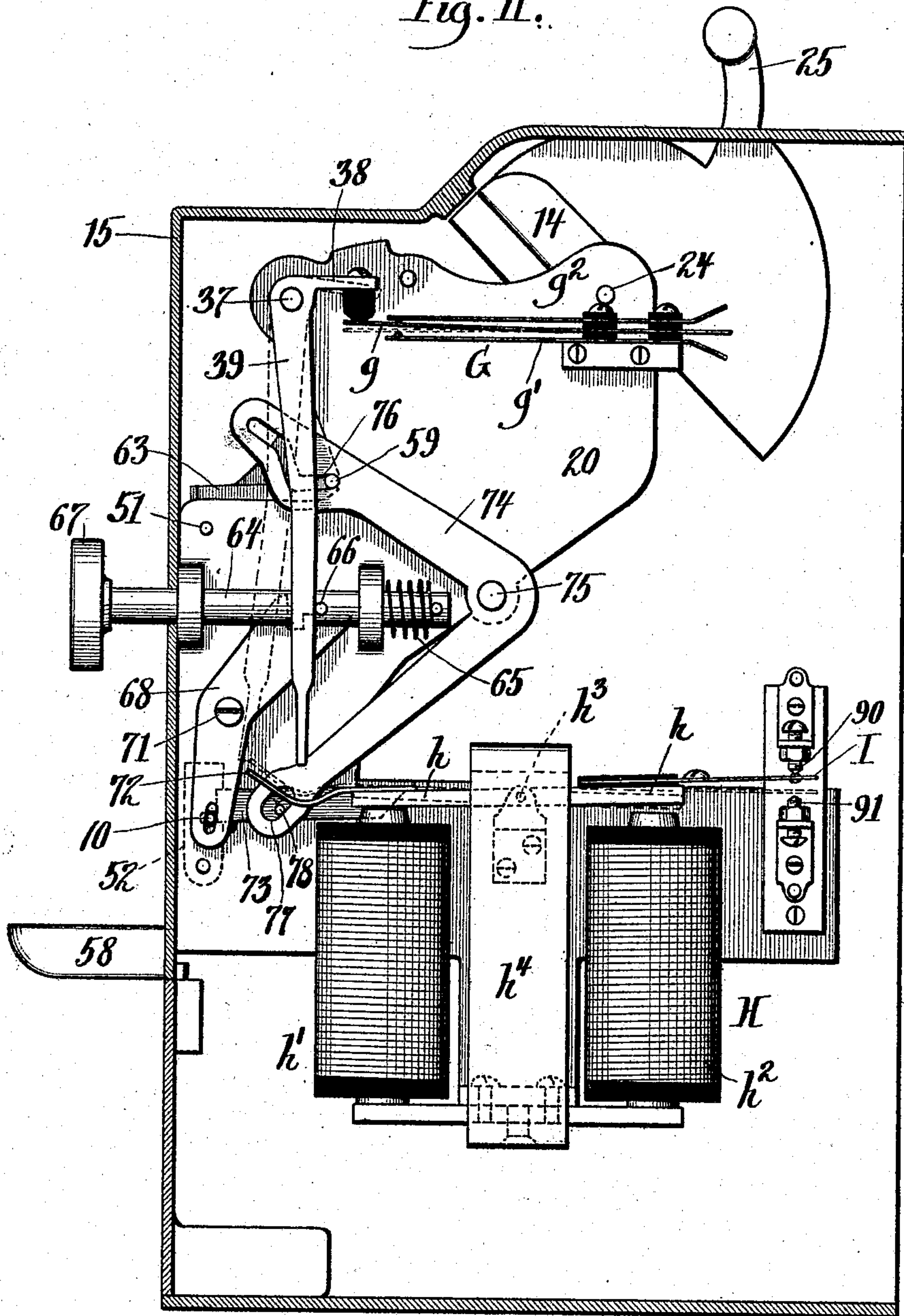
122 Inventor:
David S. Hulfish
By Fred Gerlach
his Attorney.

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4 SHEETS—SHEET 2.

Fig. II.



Witnesses:

Lillian Prentice

James H. B. H. H.

Inventor:

David S. Hulfish.

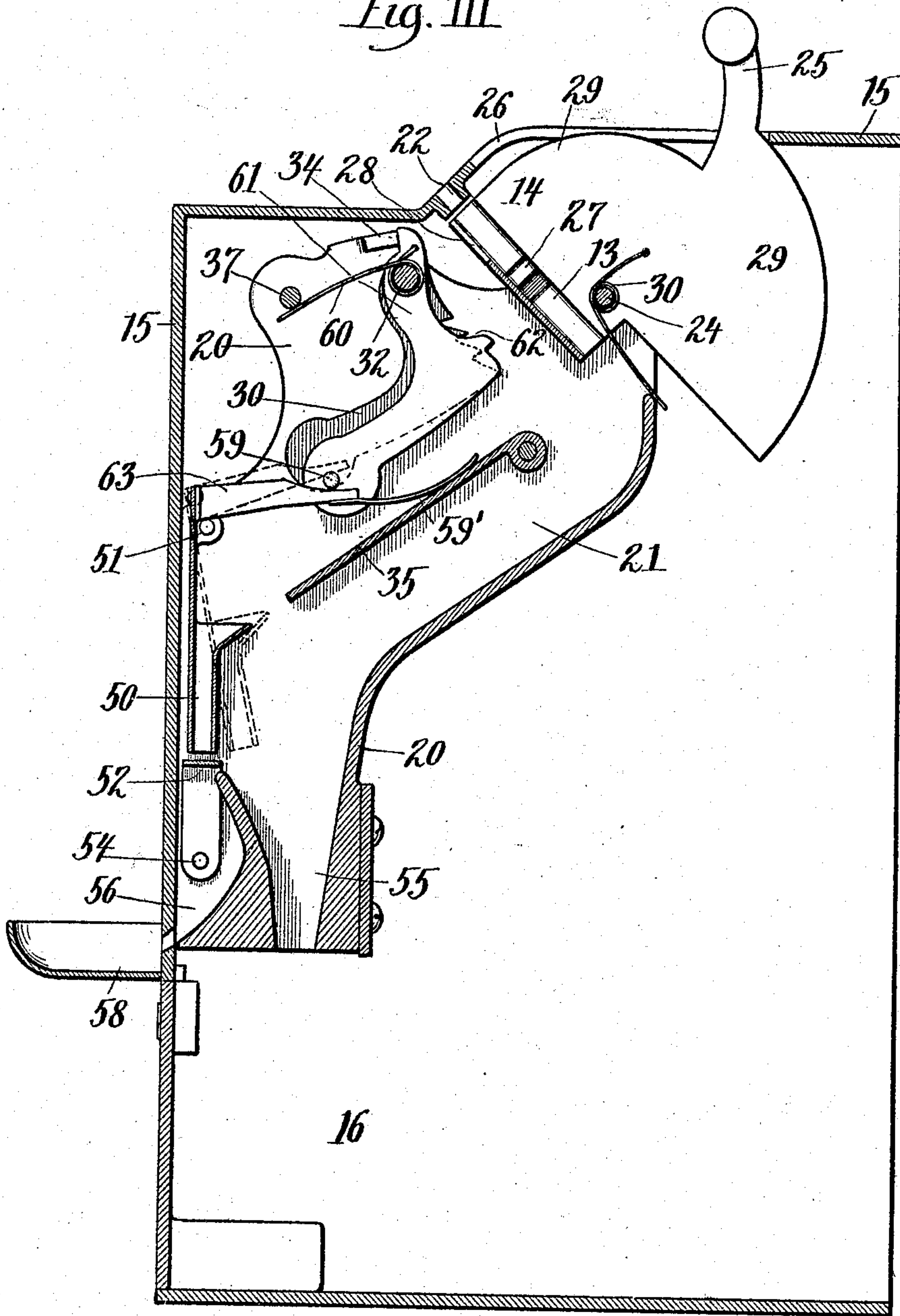
By Fred Gerlach.
his Attorney.

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APPLICATION FILED MAR. 28, 1903.

Patented Dec. 29, 1908.
4 SHEETS—SHEET 3.

Fig. III



Witnesses:

Lillian Orentice

James H. Prince

Inventor:

David S. Hulfish

*By Fred Gerlach
his Attorney.*

UNITED STATES PATENT OFFICE.

DAVID S. HULFISH, OF CHICAGO, ILLINOIS, ASSIGNOR TO BAIRD MANUFACTURING COMPANY,
OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TOLL TELEPHONE SYSTEM.

No. 907,804.

Specification of Letters Patent.

Patented Dec. 29, 1908.

Application filed March 28, 1903. Serial No. 149,983.

To all whom it may concern:

Be it known that I, DAVID S. HULFISH, a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Toll Telephone Systems, of which the following is a full, clear, and exact description.

The invention relates to telephone-systems and toll-apparatus associated therewith. A desideratum in toll-telephone-systems, is to provide a system which will not require performance of functions or attention upon the part of the central operator, other than those necessary in telephone-systems, wherefor a fixed periodical rental is paid. Performance of additional functions incidental to toll-apparatus, results in retarding the service, and delay in establishing telephonic communication between stations.

One of the objects of the invention is to provide an improved toll-telephone-system, in which no additional functions are imposed upon the exchange operator by reason of the association of toll-apparatus with the telephone-system.

The invention further designs to provide an improved system, which is automatically operated to place a deposited coin beyond control of the depositor.

A still further object is to provide an improved system, which includes a coin-distributer-mechanism which is operable to refund a coin, with automatically operating means whereby the coin will be placed beyond control of the depositor upon commencement of the desired service. Also to provide a toll-telephone-system, which includes a coin-distributer-mechanism, operable by the depositor to refund a coin, in event the telephone-line is inoperative, or the desired service cannot be given, with automatically operating means whereby the coin is placed beyond control of the depositor when the desired service is given.

Lastly, the invention designs to provide an improved toll-telephone-system, and also to provide improved toll-apparatus therefor.

The invention consists in the several novel features hereinafter set forth, and more particularly defined by claims at the conclusion hereof.

In the drawings: Figure I, is a diagrammatic view of a telephone-system, embody-

ing one form of the invention. Fig. II is a view in side elevation of the improved toll-apparatus, the inclosing case being shown in section. Fig. III is a view in central vertical section of the toll-apparatus. Fig. IV is a detail view illustrating more particularly the locking-bar and shifting-lever of the coin refunding-mechanism. Fig. V is a diagrammatic view showing the invention applied to a "party line" system.

A toll-collecting-apparatus is located at each substation, secured within a case 15, which is adjacent the telephone thereat, as well understood in the art. The several parts of the toll-collecting-apparatus are mounted in a frame 20. A coin-receiving-slot 22 formed in case 15 directs a coin into a carrier 14, which is pivotally sustained by a rod 24 and comprises a lever 25, a coin-channel 13, and wings 29, which obstruct a lever-slot 26 and one of which also obstructs coin-slot 22, when the carrier is out of normal position. The carrier is cut away or notched at 28, to expose a portion of a coin for engagement with parts hereinafter described, while the carrier is swung to discharge the coin into a distributer. A spring 30 retains the carrier in, and restores the carrier to normal position. A stop 27 holds a coin of proper size in the carrier, and permits a smaller coin to pass through coin-channel 13, into a duct 21, whereby it will be directed to coin-compartment 16, without operating the toll-apparatus. Carrier 14 positively shifts a coin and effects the operation of the certain coin-controlled and coin-shifted parts. A gravity operated toothed dog 30, pivotally sustained by a rod 32, is engaged by, and prevents retraction of the coin. The carrier discharges a coin and upon a guide 35 which directs the coin into a coin distributer.

The coin-distributer retains a coin temporarily until it is either deposited into the lower portion of case 15, which serves as a coin-compartment 16, or until the coin is refunded to the depositor. The distributer comprises a chute 50 pivotally sustained at 51 and a coin-rest 52 pivotally sustained at 54. Backward shift of chute 50, (see dotted lines Fig. III), will remove a coin from rest 52, into a passage 55 which directs the coin into compartment 16 and places the coin beyond control of the depositor. Backward shift of coin rest 52 will cause a coin held

in the distributor-mechanism to gravitate through a duct 56, and into a receiver 58, and refund the coin.

The distributor is designed to retain a coin for which service is given, until a coin is again deposited *i. e.*, a previously deposited coin for which service has been given will remain in chute 50, until a coin is again deposited, and the carrier is again operated, which operation will shift the previously deposited coin into compartment 16. An arm 61 pivotally sustained by rod 32 is provided with an edge 62 extending normally into the path of movement of a coin in carrier 14. A spring 60 retains arm 61 in normal position, against a fixed stop 34, and restores said arm to said position. A stud 59 extending laterally from arm 61, engages an arm 63, secured to and projecting inwardly from chute 50. A spring 59' located at one side of the coin-passage leading to chute 50, and out of the path of the coin, presses arm 63 upwardly, and tends to hold chute 50 in position to remove a coin held therein, into passage 55 (see dotted lines *rig. III*).

The operation of the distributor to effect final deposit of a coin into compartment 16 will be as follows, viz:—the depositor having deposited a coin into carrier 14, will, by lever 25, shift the carrier and discharge the coin from the carrier into chute 50. During such movement the coin will engage edge 62 and shift arm 61 forwardly, whereupon the chute 50, under stress of spring 59' and restricted by stud 59, will be shifted into position seen in dotted lines *Fig. III*, and remove the coin (if any) into compartment 16. Edge 62 of arm 61 is formed to effect the shift of chute 50 during the initial part of the downward movement of carrier 14 and so chute 50 will be restored to normal position before the last deposited coin is discharged from the carrier, and in readiness to receive said coin.

The distributor is, preferably but not essentially, operable by the depositor to permit a deposited coin to be withdrawn in event the desired service cannot be given, or if the telephone-line is inoperative. The depositor can shift rest 52 to refund a coin, by a reciprocable plunger 64, yieldingly held in normal position by a spring 65 and extended to the outside of the case, and there provided with a handle 67. A stud 66 projecting laterally from plunger 64 engages the upper end of a lever 68, pivotally sustained at 71, the lower end of which is connected by a pin 70 with coin-rest 52. A locking-bar 73 is shifted by an armature h of a polarized relay H and swings into and out of the path of movement of pin 70 and thus locks and releases coin-rest 52. When said rest is locked, the refunding mechanism of the distributor will be inoperative. Lever 68 is positively shifted in both directions by stud 66 which engages a recess, (see *Fig. IV*), formed in the

upper end of said lever. Lever 68 and rest 52 are normally held by a suitable stop such as the casing, which restricts the forward movement of rest 52 and stud 66, which prevents lever 68 from moving in reverse direction. Such construction avoids the use of a spring. Stud 66 is also projected outwardly from rod 64, and engages a switch-lever 39, pivotally sustained at 37. Lever 39 operates an arm 38 by which the relative position of the contact-terminals of a switch G are determined. Switch-lever 39 is adapted to be held in shifted position (dotted lines *Fig. II*), by a latch 72 shifted by armature h of relay H.

Locking-bar 73 releases the refunding-mechanism after each deposit of a coin to permit the coin to remain within control of the depositor until the desired service is commenced. Such release is effected by a lever 74, pivoted at 75 and provided with a cam-slot 76, whereinto stud 59 of arm 61 is extended, and said lever is connected with locking-bar 73 by a stud 78 and slot 77. Slot 77 permits locking-bar 73 and armature h to move into either of two positions, independently of lever 74. Slot 77 is formed to shift lever 74 in such manner that locking-bar 73 will be moved into position to release the refunding-mechanism after each deposit of a coin. If locking-bar 73 remains in position shown in full lines *Fig. II*, after an operation, (which occurs when service is given for a deposited coin), lever 74 during its return movement will not shift bar 73, so armature h will remain in position to render the refunding mechanism operable because the upper edge of slot 77 will not engage and shift pin 78 during such return movement. Lever 39 operates switch G to render the telephone-line inoperative, when a coin is refunded and in such event, said lever will be held in position to thus maintain the telephone-line until lever 39 is released from latch 72. When lever 39 remains in such position and lever 74 is operated by a deposited coin, latch 72 is shifted in one direction sufficiently to release lever 39 but the shift thereof is insufficient to return bar 73 to its locking position, and then also permanent magnet h^4 tends to hold the armature in its unlocked position.

The refunding-mechanism becomes operable after each deposit of a coin and if switch G has remained in shifted position from the last operation, (dotted lines *Fig. II*), the switch will be restored to normal position. Polarized relay H comprises helices h' , h^2 , and an armature h centrally pivoted at h^3 . A permanent magnet h^4 holds armature h in assigned position until shifted by the preponderating force of helices h' , h^2 , or by manually-shifted lever 74. This polarized relay is wound and constructed to shift armature h into one position when current of one direction or polarity is sent through the

armature and so current of reverse direction or polarity will energize the helices differently and shift the armature into another position.

5 A switch I is shifted by armature h and is adapted to make contact with a contact-terminal 90, when the armature is in one position, and with terminal 91, when the armature is in the other position. Switch I
10 when shifted by a deposited coin into contact with terminal 91, will establish a grounded connection for a circuit which causes actuation of the line-signal at the exchange. Switch I will remain in such position until
15 current of reverse polarity is impressed upon a circuit in which helices h' , h^2 are included. This shift of armature is automatically effected by response of the person at the called substation. Such shift will remove the
20 grounded connection from the telephone-line and simultaneously render the refunding mechanism inoperative and place the coin beyond control of the depositor. Switch G includes a contact-spring g shifted by switch-arm 38 of lever 39 and spring-contact g' connected with switch I, and a spring g^2 connected
25 by conductor 97 with a telephone-set 99.

If a deposited coin is not refunded, lever 39 will remain in normal position and the telephone-line will remain operative. When a
30 deposited coin is withdrawn, (which is possible only when latch 72 is in position to hold lever 39), the depositor will pull plunger 64. Such operation will shift stud 66, lever 39
35 which will be held in shifted position by latch 72. With lever 39 in such position, spring-contact g will be disengaged from contact g^2 , and the telephone-line will be interrupted at such points, so telephonic communication
40 over the line will be impossible, and spring-contact g will be in contact with spring g' , and will establish a circuit for the operation of call signal 98 at the substation in manner hereinafter described.

45 Each substation, includes a telephone-set 99, of usual construction and arrangement, and is connected with a central exchange by a telephone-line including branch-conductors 100, and 101, terminating at the central station in line-springs 116, 117 of a switch-board of usual construction. At the substation, conductor 100 terminates and is
50 connected with the telephone-set in manner shown, and conductor 101 is connected with conductor 95 and contact-terminal 90. A conductor 92 connects contact-terminal 91 with contact-spring g' of switch G and a conductor 93 extends from conductor 92 to ground 94. Terminal 90 is connected with
55 a branch 101 of the telephone-line, and with a conductor 95 in which helices h' , h^2 are included, and which is connected with contact-spring g , of switch G. A conductor 96 connects conductor 95 and switch I. Contact-spring g is normally in contact with
65

spring g^2 , which is connected with a telephone-set 99 by a conductor 97.

The switch-board and associated apparatus at the exchange comprise a line-relay 102, a switch 103, controlling passage of current over a local circuit in which line-signal 104 is included and a battery 105 connected with conductor 106 (wherein line-relay 102 is included), and with ground 108 by conductor 107. Conductor 106 terminates adjacent a switch 109 connected by a branch-conductor 110 with line-conductor 100. A cut-out relay 111 is connected by a conductor 112 and branches 113 thereof, with the several test-rings 114 of each spring-jack, and by conductor 115 with a conductor 107, grounded at 108. Fig. I shows a substation A connected with a switch-board B at the exchange and a substation C connected with a switch-board D at the exchange. The exchange is also equipped with a cord-loop E including usual plugs 119, a centralized battery 120 connected by a conductor 121' with ground and supervisory signals 121 and 122. The tip of plug 119 is connected by conductor 123 with one side of battery 120. The sleeve of plug 119 is connected by conductor 124 with the other side of battery 120. Supervisory relay 125 is included in conductor 124. A conductor 126 connects the body of plug 119 and a conductor 127 leading from one side of battery 120. A switch 128 and relay 125 control operation of the circuit in which supervisory signal 122 is included. A reversing-relay 129 is included in a conductor 130 terminating adjacent switch 128 and connected with conductor 126. Relay 129 becomes energized when the called station answers a call, and shifts switches 131 and 132 to effect reversal of the direction of the current passing over the telephone-line extending between the calling station and the exchange. This reversal energizes polarized relay H in such manner that the refunding-mechanism will be locked and places the deposited coin beyond control of the depositor and disconnects ground 94 from the line and shunts relay H so the lock for the refunding mechanism can not be manipulated from the called station. A conductor 133 connects switch 131 and the sleeve of plug 118 and a conductor 134 normally engaging switch 131, is connected with battery 120. A conductor 135 extends from conductor 134 to a terminal adjacent and normally out of contact with switch 132. A conductor 136 connects switch 132 and the tip of plug 118. A conductor 137 normally contacting with switch 132 is connected with the opposite side of battery 120. A branch conductor 138 extends from conductor 137 to a terminal adjacent and normally out of contact with switch 131. Supervisory relay 139, which controls signal 121 is included in con-

ductor 137. A conductor 138' in which supervisory signal 121 is included, connects conductor 127 and the body of plug 118. A switch 141 is connected with conductor 127 and is adapted to engage the terminal of a conductor 140 connected with conductor 138' and to exclude current from signal 121, when the line is operative. A "ringing-key" 142 of usual construction is connected as shown, and thereby alternating current may be impressed into the line from a generator 143 connected with ground at 144. It will be understood that the cord-loop has associated therewith, the usual apparatus such as operators' telephone-set, listening-key, and resistance-coils, the arrangement of which are well understood in the art, and need not be specifically described.

The operation of the improved telephone-system will be as follows:—A person, *e. g.*, at substation A, desiring telephone-service deposits a coin through slot 22 of the toll-receiving-apparatus, into the coin-carrier and then operates the carrier to discharge the coin into the distributor and to effect the actuation of the line-signal. During the initial part of the shift of the coin in the carrier, arm 61 will release chute 50 and permit spring 59 to shift said chute to deposit a previously deposited coin (if any) into compartment 16. Before the last deposited coin reaches distributor-chute 50, said chute will have been returned to the position seen in Fig. III, in readiness to receive the last deposited coin, which will be discharged and be temporarily held in chute 50 in readiness to be withdrawn if the telephone-line is inoperative, or service cannot be given, or to be secured therein against withdrawal as soon as the desired connection is made. During each operation of arm 61 resulting from deposit of a coin, lever 74 will shift armature-switch I, into engagement with terminal 91 and close an electrical circuit which causes actuation of line-signal 104 of the calling station as follows, viz:—ground 108, conductor 107, battery 105, conductor 106, relay 102 (which operates switch 103 and controls the local circuit in which line signal 104 is included), switch 109, all of switch-board B, conductor 110, line-conductor 100, telephone-set 99, and the switch-hook thereof, conductor 97, springs g^2 and g of switch G, conductor 96, switch I terminal 91, conductor 93 and ground 94. Line-relay 102 will close the local circuit of line-signal 104 and notify the exchange-operator of the deposit of a coin and that a connection is desired. The line-relay remains actuated until the operator responds to the call by inserting a plug into the jack unless the coin is withdrawn.

Assuming that the coin is not withdrawn, the operator will insert plug 118 into one of the spring-jacks of switch-board B. A circuit for speech-transmission between the ex-

change and the calling substation will then be established as follows:—battery 120, conductor 134, switch 131, conductor 133, sleeve of plug 118, line-spring 117, line-conductor 101, conductor 95, in which relay H is included, conductor 96, normally closed contact-springs g , g^2 , conductor 97, telephone-set 99 in usual manner (the receiving instrument being removed from the switch-hook), line-conductor 100, line-spring 116, tip of plug 118, conductor 136, switch 132, conductor 137, relay 139, and back to battery 120. Current passing over this circuit will be of that sign or polarity which will confirm the position (dotted lines Fig. II), of switch I and retain the switch in contact with terminal 91. When said circuit for speech-transmission has been completed, circuit will also be established as follows, viz:—grounded conductor 121', battery 120, conductor 127, switch 141, conductors 140, 138', body of plug 118, test-ring 114, conductors 113, 112, cut-out relay 111, conductors 115, 107 and ground 108. Energization of relay 111 will shift switch 109 and break the signaling-circuit thereat, and discontinue the actuation of line-signal 104. While relay 139 is energized, supervisory signal 121 will be inactive. When the circuit for speech-transmission is broken either at the switch-hook or switch G of the calling station, relay 139 will be de-energized, and switch 141 will interrupt passage of current over the signal circuit from battery 120 except said signal, which will notify the operator of the circuit for speech-transmission resulting when the depositor restores the receiving-instrument upon the switch-hook after service, and if the depositor withdraws the deposited coin, the circuit will be interrupted at switch G. Therefore, the coin cannot be withdrawn from the toll-apparatus without knowledge of the exchange operator.

The operator ascertains in usual manner as well understood in the art, the station where-with connection is desired, and next ascertains whether or not service can be given. Assuming that the line wherewith connection is desired is free, the operator will insert plug 119 into one of the jacks of the called station, *e. g.*, switch-board D. The calling substation will be notified by "ringing-key" 142 that a connection has been made. An electrical circuit for the operation of call-signal 98 at the "called" station will be established as follows, viz:—grounded conductor 144, generator 143, conductor 124, sleeve of plug 119, line-spring 117, line-conductor 101, terminal 90, switch I, conductor 96, springs g , g^2 , conductor 97, the condenser of the telephone-set and call-signal 98 to ground. Said circuit will be established in said manner if switch I has been left in position shown in Fig. I, after the last operation of the toll-apparatus. If switch I is left in the other posi-

tion, the call signal will be actuated as hereinafter described. Exchange-operator having inserted plug 119 into the jack of the called station, can then give attention to the other connections which may be desired. It is not necessary to wait until the called substation has responded to the call nor is it necessary to give any attention to the operation of the toll-apparatus as the further operation is automatic. Circuit for speech-transmission between the exchange and the called station is interrupted at the switch-hook of the telephone-set thereat, until the call is responded to. When the person at the called station removes the receiving-instrument from the switch-hook circuit will be automatically established whereby a coin held in the distributor of the toll-apparatus at the calling station will be placed beyond control of the depositor. As soon as the service commences, the coin is automatically disposed of, and placed beyond control of the depositor. If the call is not responded to, the coin can be withdrawn as the refunding mechanism will be operable.

When plug 119 is connected with the line of the called station, current for actuation of supervisory signal 122 will pass as follows, viz:—grounded conductor 121' battery 120, conductor 127, conductor 126 (in which supervisory signal 122 is included), body of plug 119, test-ring 114, conductors 113, 112, relay 111, conductors 115, 107 and ground 108. When the line is in use, the supervisory signals (usually lamps) are inactive but as soon as the telephone-line is interrupted, the supervisory signal will be actuated by current from battery 120. When a circuit is completed for speech-transmission, current passing through conductor 124 will energize relay 125 and shift switch 128, and thus exclude signal 122 from the circuit. Therefore, while the telephone-line is in use, the supervisory-signals will be inactive, and when the use of the telephone-line is discontinued, the supervisory signals will be active, thus indicating the condition of the line, to the operator.

When a person at the called station responds and removes the receiving instrument from the switch-hook, current for speech-transmission will be established as follows, viz:—battery 120, conductor 123, tip of plug 119, line-spring 116, line-conductor 100, telephone-set 99, conductor 97, springs g^2 , g , conductor 96, switch I, terminal 90, line-conductor 101, spring 117, sleeve of plug 119, conductor 124, supervisory-relay 125, and back to battery 120. Energization of relay 125 will establish a circuit which excludes supervisory signal 122, including reversing relay 129. Said circuit will be as follows, viz:—grounded conductor 121', battery 120, switch 128, conductor 130 (wherein relay 129 is included), conductor

126, body of plug 119, test-ring 114, conductors 113, 112, 115, 107 and ground 108. Relay 129 will shift switches 131 and 132 and effect reversal of the flow of potential from battery 120 over the telephone-line extending between the calling station and the central exchange. When switches 131, 132 are in said shifted position, current for speech-transmission between the exchange and the calling station, and for operation of relay H, of the toll-apparatus will pass as follows, viz:—battery 120, conductors 134, 135, switch 132, conductor 136, tip of plug 118, line-spring 116, line-conductor 100, telephone-set 99, conductor 97, springs g , g^2 , conductor 96, conductor 95, in which helices h' , h^2 of polarized relay H are included, line-conductor 101, line-spring 117, sleeve of plug 118, conductor 133, switch 131, conductors 138, 137 to battery 120. Such reversal of current will differentially energize relay H and effect shift of armature switch I into position to operate locking-bar 73 and render the refunding-mechanism inoperative and exclude the grounded conductor at the substation from the line. The coin then passes beyond control of the depositor at the calling-station. The means thus described are operated automatically upon response at the called station and dispose of the coin deposited at the calling station insofar as the depositor is concerned.

When relay H has been actuated as a result of the reversal of the flow of current over the telephone-line and when the person at the called station responds, armature h will be shifted and will be no longer susceptible to change by switch 31, 32. When switch I has once been shifted, it will provide a direct passage for current and from which relay H is excluded. Resultantly, repeated operation of the relay H which would release the refunding mechanism and permit withdrawal of a coin when the receiver is replaced upon the switch-hook at the called station, is impossible because the relay is no longer responsive to current change in the line, until the toll-apparatus or call-signal is operated. After reversal of current and operation of the polarized relay, current at the calling station will pass from line-conductor 100 as before, to telephone 99, conductor 97, switches g^2 , g , conductors 95, 96, switch I terminal 90, conductor 101, and back to exchange. Direct passage of current through switch I will shunt helices of relay H from the circuit and prevent further operation of armature h by manipulation of the switch-hook at the called station.

In event the desired service cannot be given, *e. g.*, if the telephone-line extending between an exchange and the substation is "busy," or inoperative, the operator will not insert plug 119 into a spring-jack and will inform the patron at the calling station

by "busy" signal or orally as well understood in the art, that the desired service cannot be given. At such time, switch I contacts with terminal 91 and the refunding-mechanism is operable because the switch will not then have been shifted from the position assumed after deposit of a coin. The depositor when informed that the desired service cannot be given, will pull plunger 64 and operate the refunding-mechanism.

When a coin is withdrawn, the telephone-line between substation and the exchange is broken to prevent operation of the line-signal until a coin is again deposited and in such manner that the call-signal can be actuated from the exchange. After operation of the refunding mechanism, lever 39 will be held by latch 72 until armature h is again shifted to release lever 39. After operation of the refunding-mechanism armature h remains in position seen in dotted lines Fig. II and terminal 72 thereof, projects slightly into the path of the lower terminal of lever 39. In moving forwardly, lever 39 will depress terminal 72 slightly, and only to such an extent, that permanent magnet h^4 will restore the armature to said position and cause terminal 72 to arrest switch-lever 39. Switch-arm 38 depresses spring g out of contact with spring g^2 and into contact with spring g' . The line-signal will then be inoperative, because circuit for the line-signal will be open at contact-spring g^2 . Therefore, when the coin is withdrawn, actuation of the line-signal is forthwith discontinued and the line-signal is rendered inoperative until a coin is deposited. The line however, remains in condition to permit the exchange operator to actuate the "call signal".

When connection is made after a service, the system will remain in condition to permit the operation of the call-signal from central office by operation of ringing-key 142. Alternating current for the operation of the call-signal will pass as follows:—grounded conductor 144, generator 143 one of the switches of key 142, conductor 124, the sleeve of plug 119, line-spring 117, line conductor 101, terminal 90, armature switch I, conductors 96, 95, springs g , g^2 , conductor 97, through the conductor in which the condenser is arranged, call-signal 98 and to ground.

When a coin is withdrawn the telephone-line remains in such condition that the call-signal can be actuated while the line-signal is inoperative, until a coin is deposited. Shift of spring g into engagement with contact-spring g' , breaks the line-signal-circuit and makes connections whereby the call-signal can be operated. The telephone-line is opened at switch G by withdrawal of a coin, but the operator actuates the call-signal by operation of ringing-key 142, which will cause current to pass as follows, viz:—

grounded conductor 144, alternating current generator 143, conductor 124, sleeve of plug 119, line-spring 117, line-conductor 101, conductor 95, helices h^2 , h' conductor 96, switch I, terminal 91, conductor 93 and ground 94. Alternating current will produce a vibration of armature h , which will then withdraw contact-spring g and said lever will be restored to normal position. Thereupon alternating current will flow from conductor 101, and through switch I, conductor 96, spring g , g^2 , conductor 97, through the condenser of the telephone-set, call-signal 98 and to ground. Thus actuation of the call-signal automatically restores the telephone-line to normal position, so communication can be had with the substation (as a "called" station), if the line remains broken by reason of the operation of the refunding-mechanism, and simultaneously renders the refunding-mechanism inoperable. The call-signal is operative regardless of the condition of the line, *i. e.*, while switch G is in normal or other position.

If the next call originates at a substation, while switch G and armature-switch I are in shifted position, lever 74 upon deposit of a coin will first shift armature h to release lever 39 and restore spring g to normal position and then reversely shift armature h , switch I and locking-bar 73 into position shown in dotted lines Fig. II. During deposit of a coin, stud 59 of lever 51 first shifts armature h downwardly to release lever 39 and thus restore the telephone-line to normal condition at switch G, and then shifts the armature reversely, to connect the line-conductor with ground to complete a circuit for actuation of the line-signal. Switch I is thus restored to normal position by operation of the toll-apparatus and by actuation of the call signal.

In Fig. V, a connection at a substation adapted for use in systems in which several substations are connected with a telephone-line extending to the exchange, and generally known as "party-lines". In such systems, it is now common practice to provide differently operated call signals, whereby the central office can by differential or selective means, call each of the substations connected with the line. In such systems, it is common to actuate the call-signal or one or more of the stations connected with the line by sending alternating current over one of the branch conductors thereof, and of one or more of the other stations, by impressing alternating current upon the other line-conductor. The present system can be readily adapted for use in such systems by modifications of the construction of and the connections of switch G, the construction of the toll-apparatus being similar to that herein-after described. Switch-arm 38 in this form of the invention is arranged to simultaneously shift contact-springs g , g^2 and g^5 , nor-

5 mally in contact with springs g^2 , g' and g^4 , respectively, and arranged to shift springs g and g^3 into contact with springs g' and g^4 , respectively. The telephone-line and apparatus are normally in position shown and alternating current to operate the call signal impressed upon the line over conductor 100, will pass as follows, viz:—conductor 100, the condenser and call-signal 98, springs 10 g^3 , g' , conductors 92, 93 and ground 94. When switch G is in shifted position, current will momentarily pass as follows, viz:—conductor 100, the condenser and call-signal, springs g^3 , g^4 , conductor 95, helices h' , h^2 , 15 switch I, conductors 92, 93 and ground. Armature h will thereupon shift switch I which will release switch-arm 38 to restore switch G to normal position, when current will pass as aforesaid.

20 Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means, a relay included in the circuit for speech-transmission, and means whereby said relay will be short-circuited.

30 2. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving apparatus comprising coin-refunding means, a relay included in the circuit for speech-transmission and operating the toll-apparatus to retain a coin, and means whereby the relay will be short-circuited.

40 3. The combination with a telephone-line extending between a substation and an exchange, of a toll-apparatus including coin-refunding means operable by the depositor, a relay included in the circuit for speech-transmission means operated by said relay and whereby the refunding means will be 45 secured against operation, and means whereby said relay will be short-circuited from the line.

50 4. The combination with a telephone-line extending between a substation and an exchange, of a toll-apparatus comprising coin-refunding means, a switch at the substation and a relay included in the circuit for speech-transmission and operating said switch, and means whereby said relay will 55 be short-circuited from the line.

60 5. The combination with a telephone-line extending between a substation and an exchange, and a line-signal of a toll-apparatus, a switch at the substation and controlling a connection which causes actuation of the line-signal, and a relay at the substation, and included in the circuit for speech-transmission, and operating said switch to remove said connection from the 65 line.

6. The combination with a telephone-line extending between a substation and an exchange, and a line-signal of a toll-receiving-apparatus comprising coin-refunding means operable by the depositor, a switch 70 having a grounded connection causing actuation of the line-signal, said switch being shifted to make such connection, when a coin is deposited, a relay shifting said switch to remove the grounded connection from the line, and means whereby 75 said relay will be actuated.

7. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-apparatus, a switch controlling a connection 80 which causes actuation of the line-signal, and a relay at the substation and included in the circuit for speech-transmission and operating said switch to remove said connection from the line, said relay being 85 irresponsible to current for speech-transmission between the exchange and the substation.

8. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-apparatus, a switch controlling a connection 90 which causes actuation of the line-signal, and a polarized relay at the substation and included in the circuit for speech-transmission said relay being irresponsible to current used for speech-transmission and 95 responsive to current of the same potential and of different polarity when such is impressed upon the line and operating said switch to remove said connection from the 100 line.

9. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of toll-apparatus, 105 a switch controlling a connection which causes actuation of the line-signal, a polarized relay at the substation and included in the circuit for speech-transmission between the exchange and the substation, and operating 110 said switch to remove said connection from the line said relay being irresponsible to current used for speech-transmission and operated when current of different polarity is impressed upon the line, and a 115 reversing relay and connections at the exchange, whereby the polarized relay will be actuated.

10. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving apparatus, a relay included in the circuit for speech-transmission, a switch, connections whereby the relay will be short-circuited, thus rendering the relay electrically inoperative, 125 and mechanical means whereby the switch will be shifted to its alternative position.

11. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving apparatus, 130

a relay included in the circuit for speech-transmission, a switch, connections whereby the relay will be short-circuited, means whereby said switch will be held in position to short-circuit the relay, thus rendering the relay electrically inoperative, and mechanical means whereby the switch will be shifted to its alternative position.

12. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving apparatus, a relay included in the circuit for speech-transmission, a switch, connections whereby the relay will be short-circuited from the line, means whereby said switch will be held in position to short-circuit the relay, thus rendering the relay electrically inoperative and coin-operated means whereby the depositor can shift said switch into alternative position.

13. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means operable by the depositor, a relay included in the circuit for speech-transmission and a switch operated in one direction by said relay and having connections whereby the relay will be short-circuited and whereby the line-signal will be actuated and means for shifting said switch to its alternative position.

14. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means, a switch controlling a connection which causes actuation of the line-signal, a relay included in the circuit for speech-transmission and operating said switch to remove said connection from the line, and means whereby said relay will operate the toll-apparatus to retain a coin when said switch is operated to remove said connection from the line.

15. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means operable by the depositor, a switch controlling a connection which causes actuation of the line-signal, a relay included in the circuit for speech-transmission between the substation and the exchange and operating said switch to remove said connection from the line, a connection whereby the relay will be short-circuited when thus shifted and means whereby the toll-apparatus will be operated to retain a coin when said switch is shifted to remove said connection from the line.

16. The combination with a telephone line extending between a sub-station and an exchange, of a toll receiving apparatus comprising coin refunding means, a polarized relay for operating one of the parts of the toll apparatus, said part remaining unshifted when current of one polarity passes through the relay and being shifted by the relay when

current of the same potential and reverse polarity passes through the relay, and means whereby reversal of current will be effected by completion of the circuit for speech transmission between two sub-stations.

17. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means, a polarized relay having an armature not shifted by current of one direction, but shifted by the same potential of reverse direction automatically operating means for reversing the direction of current, a switch having connections whereby said relay may be short-circuited, and coin-operated means whereby said switch may be shifted.

18. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means, a polarized relay having an armature which is not shifted by current of one direction but shifted by current of the same potential of reverse direction, means at the exchange whereby current will be impressed upon the line in reverse direction when circuit for speech-transmission between two substations is established and means whereby the coin-refunding means will be rendered inoperative by said relay.

19. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means, a switch having connections whereby the line-signal may be actuated, a polarized relay having an armature which is not shifted by current of one direction and means at the exchange whereby current of reverse direction will be impressed upon the line when circuit for speech-transmission between two substations is established to operate said relay and said switch to remove said connection from the line.

20. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means, a switch having connections whereby the line-signal may be actuated, a polarized relay having an armature which is not shifted by current of one direction, but responsive to current of the same potential of reverse direction, automatically operated means at the exchange whereby current of reverse direction will be impressed upon the line to operate said relay and said switch to remove said connection from the line, and means whereby said relay will operate the toll-apparatus to render the refunding means inoperative.

21. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving-apparatus, com-

prising coin-refunding-means operable by the depositor, a switch connected with the telephone-line and interrupting the line when the refunding means is operated, and a relay included in the circuit for speech-transmission and restoring the switch to normal position after operation.

22. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving-apparatus comprising coin-refunding-means operable by the depositor, a switch connected with the telephone-line and interrupting the line when the refunding means is operated a relay restoring the same to normal position and means whereby the toll-apparatus will be operated to retain a coin, also operated by said relay.

23. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving-apparatus comprising coin-refunding-means operable by the depositor, a switch connected with the telephone-line and interrupting the line when the refunding means is operated, a relay restoring the switch to normal position, means whereby the toll-apparatus will be operated to retain a coin also operated by said relay and means whereby the relay will be short-circuited.

24. The combination with a telephone-line extending between a substation and an exchange, of a toll-receiving apparatus comprising coin-refunding-means operable by the depositor, a switch connected with the telephone-line and interrupting the line when the refunding means is operated, a relay operating said switch to restore the switch to normal position, means whereby the toll-apparatus will be operated to retain a coin, also operated by said relay and automatically operating means for actuating said relay.

25. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-receiving-apparatus comprising coin-refunding means operable by the depositor a switch connected with the line and rendering the line inoperable when the refunding means is operated, a relay restoring said switch to normal position, said relay being actuated when the call-signal is operated by the exchange, and means whereby the refunding means will be rendered inoperable said means being operated by said relay and automatically operating means for actuating said relay to operate said means.

26. The combination with a telephone-line extending between a substation and an exchange and a line-signal, of a toll-apparatus comprising refunding means operable by the depositor, a switch interrupting the line when the refunding means is operated, and a polarized relay connected with the line and irresponsive to current normally upon the

line and responsive to current employed to operate the call-signal.

27. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-apparatus comprising refunding means operable by the depositor, a switch, and a polarized relay included in the circuit for speech-transmission and irresponsive to current normally upon the line, and responsive to current employed to operate the call signal, and means whereby said relay will be short-circuited from the line.

28. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-apparatus comprising coin-refunding-means operable by the depositor, a switch interrupting the telephone-line when the refunding-means is operated, a switch having connection whereby the line signal can be operated and a relay connected to the line so that currents normally upon the line will not actuate the relay but so current employed to actuate the call signal may actuate the relay.

29. The combination with a telephone-line extending between a substation and an exchange, and a line-signal, of a toll-apparatus comprising coin-refunding means operable by the depositor, a switch interrupting the telephone-line when the reversing means is operated, a switch having connection whereby the line-signal can be operated, means whereby the refunding means can be rendered inoperable, and a relay connected to the line, so that currents normally upon the line will not actuate the relay, and irresponsive to current of reverse polarity and responsive to current employed to operate the call signal at the substation, said relay operating both of said switches and said means.

30. In a toll-apparatus, for telephones, the combination with a coin-refunding means operable by the depositor, of a relay, means for rendering the refunding means inoperable, and shifted by said relay into position to render the refunding means inoperable and a permanent magnet holding the armature of the relay in assigned position.

31. In a toll-apparatus, for telephones, the combination with a coin-refunding means operable, by the depositor, of a relay and means for rendering the refunding means inoperable, and shifted by said relay into position to render the refunding means inoperable, and means whereby said means will be shifted when a coin is deposited.

32. In a toll-apparatus, for telephones, the combination with a coin-refunding means operable by the depositor, of a relay, means rendering the refunding means inoperable, shifted by said relay into position to render the refunding means inoperable, means

whereby said means will be shifted when a coin is deposited, said relay comprising a permanent magnet holding the armature or the relay in assigned position.

5 33. In a toll-apparatus for telephones, the combination with a coin-refunding means operable by the depositor of a switch controlling actuation of the line-signal, and shifted to one position when a coin is de-
10 posited, means whereby the refunding means will be rendered inoperative and a relay shifting said switch to its other position and operating said means.

34. In a toll-apparatus for telephones, the
15 combination with a coin-refunding-means operable by the depositor of a relay, means operating the apparatus to retain a coin and shifted by said relay, a switch operated when the refunding means is operated and render-
20 ing the line inoperative, said switch being held in shifted position, and restored to normal position either when a coin is deposited or when the relay is energized by alternating current.

25 35. In a toll-apparatus for telephones, the combination with a coin-refunding-means operable by the depositor of a relay and means operating the toll-apparatus to retain a coin, and shifted by said relay, a switch
30 operated by the refunding means, a switch controlling actuation of the line-signal, a relay operating the line-signal, in one direc-

tion, and means whereby said switches will be shifted into normal position when alternating current has passed through the relay 35 and means whereby the interrupter switch will be restored to normal position and whereby the other switch will be operated into shifted position when a coin is deposited.

36. In a toll apparatus for telephones, the
40 combination a coin-refunding means operable by the depositor, of a switch controlling actuation of the line-signal, said switch having two positions and coin-operated means shifting said switch into shifted position 45 from normal position and from and to its shifted position, if the switch has remained in shifted position.

37. In a toll-apparatus the combination with coin-refunding means operable by the
50 depositor, of a switch operated into shifted position to interrupt the line when the refunding means is operated, means for holding the switch in shifted position, a relay which restores said switch to normal posi- 55 tion, a line-signal restored to normal position by said relay and coin-operated means shifting the line-signal to shifted position and the interrupter-switch to normal position.

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In presence of—

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LILLIAN PRENTICE.